The Incidence of Anomalous Maxillary Lateral Incisors in Relation to Palatally-Displaced Cuspids

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This study reports an exceptionally high incidence of palatal displacement of maxillary cuspids in the presence of anomalous lateral incisors, and explores some of the relationships between these teeth during the critical developmental stages. It is suggested that the possibility of palatal cuspid displacement be evaluated in all cases with anomalous lateral incisors.

According to Broadbent,[4] the arrangement of the maxillary incisor teeth during the "Ugly duckling" stage of normal development of the dentition begins with spacing of the crowns of central and lateral incisors. This is due to the restricting influence of the developing cuspids on space available for the apical ends of the roots of the incisor teeth. The incisor roots are crowded close together, causing flaring and spacing of the crowns.

As the cuspids move occlusally along the distal side of the roots of the lateral incisors, their restricting influence comes to bear on the distal sides of the crowns of the flared incisors, causing them to tip mesially. This is accompanied by a degree of distal tilting (spreading) of the now unrestricted root apices.[2]

This intimate relationship of the cuspid with the root of the lateral incisor suggests that the latter provides guidance that may be a significant factor in the normal eruption of the cuspid.

Downward migration of the cuspid follows a definite buccal path, such that this tooth is palpable high in the buccal sulcus in about the eighth year. Its eventual eruption brings it into a position somewhat buccally placed on the ridge, when compared with the immediately adjacent permanent teeth. Thus it gives the impression of a "cornerstone" of the arch.

The sequence of eruption of teeth in the upper arch generally dictates that the incisor and bicuspid teeth have already reached their places before the cuspid erupts. Should there be any degree of crowding in the arch, it will become especially evident at the potential eruption site of the cuspid, where the deciduous predecessor is significantly smaller. This situation predisposes to an exaggeration of the buccal positioning of the cuspid as it erupts.

In the population studies that have been carried out on Caucasians,[6,7,17,25] it has been shown that up to 2% of maxillary cuspids become displaced palatally and a number of hypotheses for the etiology of this phenomenon have been proposed. Broadbent mentions the long path that the tooth follows from early development to final eruption.[4] Crowding was suggested as a factor by Hitchin,[13] although it had been previously discounted by Dewel.[8] The nonresorption of the root of the deciduous cuspid was also put forward as a possible cause by Lappin.[16] A narrow maxilla combined with retroclined incisors was suggested by Kettle,[15] who went on to list such additional factors as dentigerous cysts and, for the first time, congenitally missing lateral incisors as etiologic possibilities.

The missing lateral was subsequently mentioned by both Miller[18] and by Bass[1] as an etiologic factor in the palatal displacement of the adjacent cuspid. They considered that its absence deprived the cuspid of the guidance needed for it to follow its correct eruption path. The former noted that even a rudimentary lateral could provide this guidance, since such a tooth often bears a normal root. The latter went on to list hypopituitarism, cleido-cranial dysostosis and cleft lip and palate, as additional factors predisposing to palatal displacement of the cuspid. An apparent link between impacted maxillary cuspids and generalized lateness of the dentition as a whole was noted by Newcomb,[20] while Garn and Lewis[10] noted a relationship between absent teeth and reduced size of other teeth.

Our clinical impression, based on the orthodontic treatment of well over 200 cases of palatally-displaced cuspids, indicates that an unexpectedly high proportion of these cases occurred in individuals with small lateral incisors. In order to investigate the etiology of this condition further, it was decided to examine the condition of the lateral incisor adjacent to affected cuspids.

Methods and Materials

The records of 633 consecutive patients from an orthodontic practice were examined and from these were drawn the records of all patients with a palatally-positioned maxillary cuspid and a dental age of at least 13 years, as established by the stage of root closure on radiographs. These cases included individuals presenting with erupted and unerupted cuspids. Diagnosis of the location of unerupted cuspids was initially made radiographically as described by Seward,[23] and in each case the diagnosis was confirmed by direct vision at the time of surgical exposure.

Fifty-five cases were obtained from that group, and an additional 33 cases that fulfilled the same criteria were drawn from the records of the Orthodontic department of the Hebrew University-Hadassah School of Dental Medicine and from another private practice in the same area.

Using study models, the maximum mesio-distal diameter of the upper and lower lateral incisors was measured. The upper lateral incisors were classified as:

1. absent
2. peg-shaped, with the mesio-distal width greatest at the cervical margin.
3. small, with the mesio-distal width equal to or smaller than that of its mandibular counterpart.
4. normal, with the mesio-distal width larger than that of its mandibular counterpart.

From these measurements, we calculated the distribution of the various incisor categories associated with palatal cuspids. We also calculated the mean diameters of the lateral incisors in affected and non-affected sides for each sex and tested the significance of differences found.

Results

Table I shows the distribution of unilateral and bilateral cases in the sample examined. Of the 88 affected patients, the number of females (62) was approximately 2½ times that of the males (26). The phenomenon occurred unilaterally in 16 of the boys (61.5%) and in 32 of the girls (51.6%).

Each affected side was included as a separate entity, resulting in 128 affected sides. Of these, only 7 female subjects showed congenital absence of the adjacent lateral incisor; no lateral incisors were congenitally absent among the males (see Table II). In only half of the cases was the lateral incisor found to have a mesio-distal diameter larger than that of the lower lateral incisor of the same side, while 17% were frankly peg-shaped. The percentage of normal and peg-shaped lateral incisors was found to be essentially the same for each sex, as was the percentage of small and missing teeth taken together.

In two cases, a lateral incisor was missing on the non-affected side, while on the opposite side a palatally-displaced cuspid was found to be associated with a lateral incisor that was reduced in size.

Table III shows the mesio-distal widths of the lateral incisors on the affected and non-affected sides, for comparison. The values for the two incisors in bilateral cases are also listed. In the unilateral cases, the lateral incisors on the affected side were slightly smaller than those on the non-affected sides in both males and females, although these differences were not statistically significant. In the bilateral cases, the averaged values of the two sides in females was the same as the averaged values of affected and non-affected sides. In the males, however, the mean value calculated for mesio-distal diameter was markedly smaller in the bilateral cases and even smaller than the average for females.

Discussion

The relatively high incidence of palatally-displaced cuspids found in females in this study concurs with the results obtained in previous studies.[7,14,21] In both sexes, the condition occurs bilaterally with similar frequencies (about 40% of cases). This suggests that, although males are less susceptible, the pattern is similar in both sexes. The increased frequency of the condition in females may be related to the higher frequency of congenitally missing and small lateral incisors in females.

It is interesting to note that in no case did the lateral incisor width fall below 3.9 mm (a female case). This supports the hypothesis of a threshhold value for tooth size,[12] below which tooth development fails to take place. The largest incisors found in affected cases, 8.0 mm in width, were seen in 2 females bilaterally and were associated with bilateral palatally-displaced cuspids. This occurred despite the fact that the lateral incisors of the males were generally larger. Furthermore, among the bilaterally-affected cases, the lateral incisors among the males were smaller than among the females, again in contradiction to the general trend.

TABLE I
Distribution of Cases with Palatally-Displaced Cuspids

	Individuals Examined		*Unilat. Cases*		*Bilat. Cases*	
Sex	*No.*	%	*No.*	%	*No.*	%
Female	62	70.5	32	36.4	30	34.1
Male	26	29.5	16	18.2	10	11.3
Total	88	100	48	54.6	40	45.4

TABLE II
Lateral Incisor Categories Associated with Palatally-displaced Cuspids.

	Females		*Males*		*All Subjects*	
Lateral Incisor	*No.*	%	*No.*	%	*No.*	%
Absent	7	7.6	0	0	7	5.5
Peg-Shaped	16	17.4	6	16.7	22	17.2
Small	21	22.8	11	30.5	32	25.0
Normal	48	52.2	19	52.7	67	52.3
Total	92	100	36	100	128	100

TABLE III
Average Upper Lateral Incisor Width in Affected and Non-Affected Sides.

	Females			*Males*		
	No.	*Mean*	*S.D.*	*No.*	*Mean*	*S.D.*
Bilateral Cases	30	6.35	1.0	10	6.02	0.9
Unilateral Cases						
Affected Side	32	6.25	0.8	16	6.36	0.7
Non-Affected Side	32	6.56	0.7	16	6.51	0.5

Thus, in our sample, the individual cases that exhibited both the largest and the smallest lateral incisors on the affected side were females (8.0 mm and 3.9 mm), while the range of extremes among the males was narrower (7.0 mm and 4.0 mm).

In the treatment of impacted palatal cuspids, certain clear-cut principles have evolved. Among these, it is well recognized that before surgery is undertaken to uncover the buried tooth, it is necessary to provide space within the arch to accommodate it. This may be achieved by extracting the deciduous cuspid together with the first bicuspid, by moving teeth distally or by gathering up anterior spaces.[3]

Once given the needed space, the palatally-placed cuspid may improve its alignment in relation to the neighbouring teeth quite spontaneously as it erupts. In a small number of cases, it will even move laterally to a sufficient degree to actually traverse the line of the cusps of the lower teeth and take up its place on the buccal side of the arch without recourse to further appliance therapy.

A coronal section of the alveolus of the buccal segments of the maxilla reveals a V-shaped structure, wide at the top and narrowing as it is viewed lower down. This gives much room for malposition in the early stages of development. However, assuming that displacement is not gross enough to make the tooth move horizontally, further downward-eruptive movement of the cuspid becomes restricted within the confines of this tapering medium. Alteration of shape is possible, as witnessed by the degree to which palatally-impacted cuspids are often quite easily palpated on the palatal side due to the expanding effect on the bone, but this is limited.

A permanent lateral incisor, however small, acts as an impediment even in a relatively spaced dentition. Spacing is usually spread out anteriorly and the lateral incisor may be in a fairly distal position, close to the deciduous cuspid.

In the absence of a permanent lateral incisor, space is available in the arch and the tooth is free to migrate mesially and buccally, causing the resorption of the roots of the retained deciduous lateral incisor or cuspid or both as it erupts into the arch in a labial or buccal position.

From this we can see that there appear to be two processes in the palatal displacement of the maxillary cuspid. The first is a developmental one, related to absence of guidance by the lateral incisor, which opens a new course for a downward path on the palatal side. The second relates to a more advanced period, when the tooth is moving down into a narrower part of the alveolar process. If given the space or only the interference of deciduous teeth, it will tend to improve its position and frequently break through the mucosa on the buccal or labial side. It is the presence of permanent tooth roots at this late stage that can prevent the rectifying movement of the cuspid. This would account for the high incidence of peg-shaped (17.2%) and otherwise small (25%) lateral incisors that were found adjacent to palatally-displaced cuspids and the relative infrequency (5.5%) of congenital absence.

The overall frequency of peg-shaped incisors in the total patient population from which this sample was drawn is lower than that of missing laterals (1.1:2.1).[5,9] In our sample, where cuspids were displaced, this relationship was reversed to an exaggerated degree. An exceptionally high frequency of peg-shaped lateral incisors was found in association with affected cuspids. Taking into consideration all anomalous lateral incisors, we find that they accounted for approximately half of the cases examined.

It has been pointed out[11,24] that small teeth tend to develop late. Any delay in tooth development will usually affect the more variable late-developing upper lateral incisor more than the stable and early-developing cuspid. Scott and Symons[22] give 4-5 months as the age of initiation of calcification of the cuspid, compared with 10-12 months for the lateral incisor. Any delay in lateral incisor development will, then, mean that it is insufficiently developed to afford critical guidance in the very early stages of development and migration of the cuspid. However, once the slow-forming lateral incisor has developed, it can block the "corrective" buccal migration of the cuspid.

We suggest, therefore, that in all cases where anomalous lateral incisors are noted, the possibility of resultant palatal displacement of the cuspid should be investigated.

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